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most brilliant electrical discharges, were the sure precursors of floods sweeping down the rocky bed of Cedar creek. The particular location of each storm was plainly indicated by the different colored mud, brought down on the swollen flood, varying from dark brown to dirty yellow or dull red. The stratified deposits thus spread over the bed of the great basin made up the permanent geological record of summer storms in the Wahsatch in 1874.

On the 20th of July I took final leave of this section of southern Utah, carrying with me many pleasant remembrances of the kindness and hospitality received from this much misrepresented Mormon people, who in supplanting the digger Indians by civilized homes of industry and refinement, are deserving of more credit than they have yet received.

The list of plants following will conclude the present paper.

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## THE INDIAN CEMETERY OF THE GRUTA DAS MUMIAS, SOUTHERN MINAS GERAES, BRAZIL.

BY PROF. CH. FRED. HARTT.

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THE Fazenda da Fortaleza, also known as Santa Anna, formerly the property of the late Barão de Lage, and probably the finest plantation in Brazil, is situated in the southern part of the province of Minas Geraes at a distance of about seventeen miles to the east of the city of Juiz de Fora.<sup>1</sup> It belongs to-day to the Conselheiro Diogo Velho C. de Albuquerque, a gentleman celebrated as a politician, and who occupies the important post of President of the União Industria road. The region in which the Fazenda is situated is composed of gneiss, similar to that of the Serra do Mar, and of the vicinity of Rio de Janeiro, and probably of Archæan age.

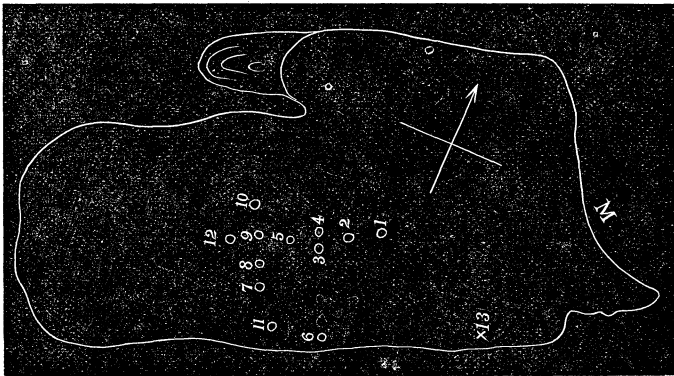
At a distance of a league, more or less, to the south or south-east of the Fazenda, is a line of high hills of the same gneiss, three of which form prominent heads presenting lofty, almost perpendicular precipices, smooth and rounded and striped vertically with black bands, like the cliffs of the neighborhood of Rio de Ja-

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<sup>1</sup> A charming description of this fazenda will be found in Madam Agassiz's "Journey in Brazil."

neiro. The easternmost of these hills, a peak probably not far from three thousand feet in height above the sea, with magnificent, nearly vertical precipices, is called the Fortaleza or the Fortress, and gives its name to the Fazenda. The second hill is lower and less prominent, but towards the northward, in its upper part, it presents a fine rounded, precipitous front, in the solid rock of which are excavated three grottos, one of which, used anciently as a burial place by the Indians, forms the subject of this paper. As this hill has, so far as I have been able to learn, no distinctive ap-

Fig. 74.



Ground plan of Gruta das Mumias showing Interments.

1. Body of child, in basket.
  2. Mummied bodies of woman and child.
  3. Skeleton wrapped in bast.
  4. " " " " " "
  5. Remains of child buried in pot.
  6. " " " " wrapped in hammock.
  - 7, 8, 9, 10. Four pots containing skeletons.
  11. Mummied bodies of mother and child buried in the same hammock.
  12. Body of little child wrapped in bast and palm straw.
  13. Locality where arrow was found.
- The compass bears N. magnetic.

pellation, I have taken the liberty to name it after my distinguished friend the proprietor of the Fazenda, calling it the Morro de Diogo Velho. The third mountain is a fine dome about two thousand feet in height, known as the Morro da Babylonia, from whose top a magnificent view of the country to the northward is to be obtained.

In the two last-named hills the beds of gneiss dip to the south-southeastward at an angle of about 40°

The largest of the caverns, known as the Gruta das Mumias, is situated near the base of a precipice on the northeastern side of

the Morro de Diogo Velho, and at a height of about seven hundred feet above the level of the Fazenda. It consists of an irregular excavation which penetrates the hill in a direction S. 60° W. (mag.) its axis being considerably inclined so that from the mouth to the end of the cave, the floor offers an ascent.

The roof and sides of the cavern form together an arch whose curves are sometimes quite regular. In various parts of the grotto there are in the sides and roof more or less deep, rounded excavations that penetrate the rock in various directions, much resembling potholes, but which are, however, not due to the action of water. On the eastern side of the cavern is one of these excavations which is extending itself in a direction parallel to the axis of the cavern, but has not yet reached the same depth. It is separated from the main hall by a narrow wall of rock which is gradually breaking down and disappearing. Originally, probably, this wall extended farther toward the mouth of the cavern.

The floor of the cave before being disturbed by the work of exploration consisted of a bed of fragments of rock, fallen from the roof and sides, and mingled with earth derived from the decomposition of the gneiss, from the dung of jaguars, bats and other animals, and from the destruction of the enormous clay nests of a large species of bee, which inhabits the cave, building on the roof. When the cavern was discovered the floor was strewn with fragments of these nests, sometimes three feet or more in diameter.

The cavern measures approximately seventy-five feet in length, twenty-five in breadth at the mouth, forty-two feet in greatest breadth and twelve feet more or less in height. The gneiss in which it is excavated consists of distinct, thin, alternating bands of which some are made up principally of a very black mica in small crystals. Others are, for the most part, composed of little grains of silica with but little feldspar, while yet others consist of a mixture of quartz and feldspar rather coarsely crystallized. It is noteworthy that the rock contains no garnets. The beds are inclined to the south-southeastward at an angle of 40°-45°±, and are full of small, but sharp plications, which, together with the alternation of the white and black bands, give to the rock, as clearly exposed on the sides and roof of the cavern, an exceedingly beautiful appearance. The second cavern is in this respect perhaps even more noteworthy than the first.

Examining the surface of the rock in the interior of the grottos it will be seen that the gneiss is suffering a very rapid decomposition, and is scaling off in thin flakes, which are sometimes so soft as to break up readily between the fingers.

As the gneiss is very compact and had originally but few fractures, and as the decomposition progresses from the outside inwards, the rock of course decomposes concentrically, giving rise to more or less regular, concave surfaces. The surface of the rock inside the cavern is constantly damp, but not sufficiently wet to drip. I suppose that this dampness is for the greater part caused by the soaking through the solid rock of water from above, and that the decomposition is caused mainly by the action of carbonic acid derived from the air.

Large caverns like that just described are rarely encountered in the gneiss of Brazil, but small ones abound and may be seen in the precipices of the gneiss hills of the vicinity of Rio.

It is somewhat difficult to determine just how the caverns of the Morro de Diogo Velho at first originated, but it is very likely that they commenced by the decomposition of an isolated mass in the gneiss, that had a somewhat different mineralogical composition than that of the rest of the rock. Ordinarily, cavities of this kind soon disappear from the surface of a cliff, because of the scaling off of the thick, half decomposed sheet, which falls from time to time, leaving a new surface exposed. It is not at all astonishing that the decomposition should go on irregularly and that the cavity should enlarge itself in some parts more rapidly than in others, giving rise to the pot-hole-like excavations above described. A very slight difference in the hardness of the rock, or in the amount of moisture, would be sufficient to determine the more rapid decomposition of a certain part of the surface, giving rise to a hollow. On the Rio Tapajos the edges of the beds of coal-measure limestone, exposed to the action of the waters of the Igarapé de Bomjardim, during the rainy season, are not dissolved away evenly, but are honeycombed with grottos. Witness also the way in which metals and other substances are honeycombed by acids.

The upper grottos of the Morro de Diogo Velho are like the lower caverns, but smaller. I shall not describe them particularly, because archæologically they do not appear to be of interest,

since they have afforded no human remains. All the caverns, contrary to the opinion of many, are natural excavations, and offer no signs of being, even in part, the work of man.

The lower and larger cavern is perfectly visible from the lowlands to the north, but as it is quite difficult of access, it does not appear to have been visited by civilized persons until, in 1871, Sr. Antunes, the administrator of the plantation, succeeded with much difficulty in reaching it. He, however, saw nothing of the archaeological treasures it contained, and their discovery remained to be made by Dr. Manoel Bazilio Furtado, a gentleman, who, much interested in the study of antiquities, has already made explorations of a sepulchral cavern, and of a rock shelter on the head waters of the Rio Itapémerim, an account of which he has promised to furnish me.

As soon as Dr. Bazilio knew of the existence of the caverns of the Morro de Diogo Velho, he visited and examined them, finding human remains in the larger one, thus proving it to be an ancient Indian burial-place. Several other visits were made to the cave, not only by Dr. Bazilio, but also by the Conselheiro Diogo Velho, and by Dr. Rozendo Muniz. About three months ago, Sr. Diogo Velho invited Dr. Ladisláu Netto, the well-known Director of the Museu Nacional of Rio, to visit and examine the locality, and to facilitate the exploration he caused roads to be cut and steps and ladders to be constructed.

Dr. Netto had the kindness to invite me to accompany him, and was so good as to delay the excursion until I could find time to go with him. On the 6th of December, we left Rio in company with Sr. Albuquerque, one of the assistants of the Museum, and M. Glaziou, the Director of the Passeio Publico of Rio, and a man who has probably done more than any one else in the way of actual botanical exploration in Brazil. As my task in this paper is simply to give an account of the scientific results of our explorations, I shall attempt no description of our most interesting journey to the Fazenda of Fortaleza, and I shall be obliged to limit myself to saying that we were overwhelmed with kindnesses and attentions by the hospitable Conselheiro and his friends. Dr. Diogo Velho placed at the disposition of Dr. Netto more than twenty slaves, under the superintendence of Sr. Antunes, and, accompanied by his associates Dr. Machado and Dr. Bazilio, he assisted us personally in the work of exploration.

In the following paper I will give not only the results of my own personal observations, but also the facts relating to the previous explorations, which were furnished me by Dr. Bazilio and Sr. Antunes, and of which my notes were written in the cavern with the greatest care, being afterwards revised by these gentlemen. Dr. Netto has very kindly permitted me to examine the objects sent to the Museu Nacional, so that in this paper I shall be able to give a very complete account of the interments found in it. A detailed description of the human remains themselves I am obliged to defer to another occasion.

As the preliminary excavations in different parts of the cavern offered us no results, we found it necessary to proceed more systematically. We first of all threw out all the large stone and rock masses that encumbered the cavern, amounting to many tons. A line of negroes was then formed across the mouth of the cavern, and the loose earth was examined to a considerable depth from one end of the cave to the other, the work occupying the greater part of two days.

On the first day nothing was found, but very early on the next morning two interments were discovered, one of a child buried in an earthen pot, the other of a young person wrapped up in a hammock, and shortly afterwards there was found the body of a little child enveloped in bast and palm straw. This was the last object discovered.

The following plan (Fig. 74) represents the floor of the cavern and the localities of the various interments, which are numbered as in the following description.

No. 1. Body of a child buried in a well-woven little basket, above which were laid several pieces of bark. Found by Sr. Antunes.

No. 2. Mummied body of a woman with a little child in her arms. These remains were sent to the Museu Nacional, but have not yet been received, so that I cannot describe them.

No. 3. Skeleton wrapped up in bast, but concerning which I could obtain no certain information.

No. 4. Skeleton of a man (?) found wrapped up in bast and afterward in palm straw. It was found sometime before our visit, and had been unwrapped, the bones having, however, been left in the cave. The skull is remarkable for a perforation near the crown, apparently the result of a wound. The remains were to

be sent to the Museum, but not having arrived at time of writing, I have not been able to examine them closely.

No. 5. Bones of a child buried in an earthen vessel, and discovered during our exploration.

The upper part of the *ygaçába* was wanting, together with a large part of the bones, including the skull, and the remaining parts of the vessel were broken, the fragments however remaining *in situ*. The pot was ovoidal in shape, the lower part resembling the tapering end of an egg. It was not at all flattened, and consequently the vessel could be kept upright only by being set in the ground or supported in some way. The material of which it was constructed was clay mixed with somewhat coarse sand. The vessel appears to have been made over a mould; indeed it would have been difficult to build it up in any other way. The inside is slightly rough, showing no signs of having been smoothed by a finishing tool, whose marks are however clearly observable on the outside surface. No signs of paint, of varnish, or of decoration of any kind, were observed on the parts of the vessel preserved.

The burning was incomplete, and for about one-third of the thickness from each surface, the clay of the walls is well reddened, the interior remaining of a grayish color. In the pot were found the following bones belonging to the skeleton of a young person:—The femur, tibia and fibula of one leg, united by the dried ligaments and with parts of the muscles preserved, the knee being flexed, showing that probably the body was buried with the knees doubled up against the breast. There were also the united bones of a fore arm, a scapula, a hand, six dorsal vertebræ, four ribs of the left side united, and in addition six ribs, separated. The rest of the bones were wanting, and I doubt whether they existed in the vessel when it was found by the negroes, for I searched carefully in the earth thrown from the spot, but could find nothing. It seems therefore probable that at some previous time the grave had been disturbed, perhaps by some wild beast. The bones were found mingled with a light earth which appeared to be mainly composed of organic matter, and to be full of the skins of the larvæ of the insects that attacked the body.

In the same earth were also found a number of seeds, which M. Glaziou identified as belonging to a species of *Anona* or custard apple. There were also found numerous fragments of the pinnules



of a species of palm which the same botanist recognized as *Geonoma pinnatifida*. It is probable that the body was wrapped in this palm straw before being deposited in the *ygaçába*. The fragments of the vessel and the bones were destined for the Museu Nacional.

No. 6. Remains of a child from seven to ten years of age, found wrapped in a hammock, and discovered on the second day of our exploration. I assisted in their disinterment, and examined attentively their disposition in the grave.

The body, which is now in part reduced to the state of a mummy, was doubled up with the knees against the breast, and then wound about with the hammock, having exposed the upper part of the head and the feet which last protruded through the hammock. The bundle when found was oval and flattened, and about two feet long. The head was turned toward the left and the body, perhaps owing to the pressure of the superincumbent earth, rested on the left side. The feet were directed towards the mouth of the cavern. The grave was not more than eighteen inches or two feet deep.

The soft parts of the body had for the most part disappeared, but there still remained a part of the scalp with a few hairs and the skin of the trunk which was dry like parchment.

I have not yet been able to examine carefully the hammock, but it appears to be constructed like that which was found wrapped about the woman in the interment No. 11. It is however made of the fibres of a palm, *Astrocaryum tucum*, and not of cotton.

Underneath the hammock adhered what seemed to be fragments of large leaves, that had been laid in the bottom of the grave before the body was deposited. By the side of the hammock there were also found fragments of palm straw, which made me suspect that outside of the hammock was a wrapping of this material. Above the body in the grave, were found a few little sticks which were disarranged in digging. The body was covered simply with earth and stones. The body, still wrapped in the hammock, will be preserved in the Museu Nacional.

Nos. 7, 8, 9, 10. Four *ygaçábas* buried in a line transverse to the grotto. They were extracted before our exploration, and are said to have been sent to the private museum of His Majesty the Emperor, but they have not yet arrived there. The fourth, No. 10, was broken in extraction, and I saw fragments in the hands of Sr. Antunes at the Fazenda. Dr. Bazilio has furnished me with some important notes on each of the four interments.

The *ygaçábas* were all ovoidal in form, without base, and were buried upright. The mouth of each was closed by a round, thick piece of the bark of the *Jequitibá*, set into the orifice. Outside, the urns were covered with a sort of basket-work of the bast of the *Embaúba tînga*, a species of *Cecropia*, and to this was attached a cord extending across the mouth to serve as a handle, the shape of the *ygaçábas* rendering it necessary to provide means of this kind for their conduction. It is worthy of note that all the urns are small and contain only the bones of children.

Over the mouth of No. 8 was found a small basket a little more than eight inches in diameter and made of *cipó tînga* a kind of lliana, which had been split, carefully prepared and woven in an open manner, the basket being furnished with a cord across the mouth, to serve as a handle. It contained a number of little bundles of palm straw, similar to those that form the outside covering of the body in No. 12. The basket was crushed flat by the weight of the earth and stones. By the side of the same *ygaçába* was found interred a bundle of five sticks, bound near each end by a bit of *cipó*. These sticks were of about the thickness of a finger and four were about three feet in length, the fifth was somewhat shorter. They were all sharp at one extremity and blunt and polished at the other. My friend Dr. Muniz Barretto, who was present when the pot was found, tells me that it contained the skeleton of a child wrapped up in bast and palm straw, forming a bundle which was afterward tied up with a cord of the palm fibre.

By the side of No. 9, and in part bent over the mouth of the pot, was found a "bornal de caça" or a sort of small haversack, woven in an open manner of palm fibre thread, and furnished with a long cord by which it might be carried like a game bag. According to the description of Dr. Bazilio this "bornal" was of exactly the same shape as the sacks used at present, not only by the Botocudos but also by many other Indian tribes of Brazil. The sack was full of little bundles of palm straw, similar to those found in the basket accompanying No. 8.

The *ygaçába*, No. 10, broken in extraction, contained the bones of a child of about twelve years of age and which had already finished its first dentition. The vessel of which Sr. Antunes showed me fragments, was of the form of an egg truncated at the larger end. The mouth was large and entirely without lip. The

interior of the vessel showed the casts of striæ on the mould. The exterior surface was moderately well worked down, showing, however, long, hard marks of the finishing tool. There were no signs either of ornament or of glazing.

The four *ygaçabas* were separated one from the other by little sticks, which circumstance makes me suspect that they were all deposited together.

On the surface of the ground near the pots, but in a position which I am unable to indicate on the plan, was found the body of a child probably wrapped up in bast.

No. 11. Mummied bodies of a mother and new-born child, wrapped in the same hammock. These most interesting specimens are preserved in the Museu Nacional where I have had an opportunity of examining them. The body of the woman is a natural mummy, simply preserved in a half decomposed and dry state. The skin remains on nearly the whole body, and, so perfect is the state of preservation, that the lower lip remains, and the feet are simply shrivelled up. The body reclines somewhat on the left side. The head is turned to the left. The left hand was placed on the breast and the right was held just above the abdomen. The legs, partially drawn up, are bent over to the left. The body bears no ornament.

By the left side of the corpse was found a little bundle containing the dried-up, natural mummy of a new-born babe, much doubled up and wrinkled and but little discolored. The skin is well preserved. The left arm bears a sort of band of woven string, and on one leg is a string of beads made of rather wide sections of a hollow bone strung on a coarse thread, a touching evidence of tenderness. The body was wrapped up in bast, and tied outside with a coarse string which passed through the fingers of the right hand of the woman, who in death was thus closely united to her offspring. It is very probable that the woman died in childbirth, but this is a question in medical jurisprudence which I am not competent to decide. Both mother and child were buried in the same hammock, which is in a fair state of preservation and accompanies the body in the museum, but, as it has been removed from the mummies, it is not possible to determine the manner in which it was wound about them. The hammock consists of rather coarse cotton thread, and is constructed like that in which the body of the young person, No. 6, is en-

wrapped. It consists of threads parallel to one another and considerably spaced, united together at intervals of a foot or more by transverse threads. At the two extremities of the hammock, the threads appear to be simply gathered together for the attachment of a stout cord for suspension.

In the manner of weaving, or rather in the arrangement of the threads, the hammocks of the cavern of the Morro de Diogo Velho bear a close resemblance to that represented in one of Lery's woodcuts,<sup>2</sup> but the form is different. Lery says that the Brazilian Indians made their *inís* of cotton thread, sometimes like a net, sometimes woven into a close cloth. Both Lery and Stade call the hammock *iní* or *inní*, a word which I have sought in vain in Tupí dictionaries, and which does not occur to-day in Lingoa geral.

On the Amazonas the name for hammock is *kyçána* (*kyçába*, old Tupí), a word which seems to have been derived from *ker* dormir (to sleep) and the termination *çábá* or *çána*, which indicates the instrument with which anything is done. In the language of the Mundurucus I have found *ûlu* and in that of the Maués *yly* meaning hammock, both of which forms may well have been derived from the same source as *iní*, as the three languages above enumerated belong to the same family.

Underneath the bundle formed by the two bodies were laid side by side a number of broad strips of coarse bark.

Over the bodies was deposited upside down a basket, well made and full of little bundles of palm straw, each with a knot. Over this were laid side by side strips of coarse bark, like those underneath the body, the whole being covered with earth.

In the same grave was found a "bortal" similar to that already described, but in a bad state of preservation.

No. 12. Bundle containing the remains of a little child, found buried at a slight depth and extracted in my presence. The body was well wrapped in the first place in strips of bast forming a little bundle scarcely eighteen inches long, a foot and a half broad and about four inches high. This package was then loosely covered on the outside with palm straw, which was tied up in a number of little bundles like those found in the baskets, and the "bortal" already described. The body was deposited immediately upon a flat stone, and over it were placed, side by side, four flat pieces of bark, about two feet long and two inches wide, forming a sort of

<sup>2</sup> Lery, *Historia Navigationis in Brasiliam*, edition 1586, p. 252.

protecting covering. The bast, palm straw, and bark are all well preserved but the package has not been opened.

I examined the cavern carefully everywhere for objects of stone, fireplaces, etc., but found no sign that it had ever been either a dwelling or that it was a place much resorted to. Sr. Antunes found on the floor of the cavern a fire brand and a long split stick which he thought might have been used to collect water, but both these objects may be very recent. In the spot marked 13 a sharpened stick was found buried. I have not seen it, but Dr. Bazilio thought it to be an arrow.

The observations made in the Gruta das Mumias show that the cavern is a natural excavation which has served as a cemetery to savage Indians. So far as the mode of burial and the preservation of the bodies are concerned it offers nothing very novel, but as an archæological locality carefully explored it is of much importance.

The Gruta das Mumias is not the only cave in Brazil in which Indian interments have been found. Dr. Bazilio found a large number of skeletons in a cave near the head waters of the Itapémerim. A similar excavation is reported to exist near Macahé, and yet another containing mummied bodies and urns in the Serra dos Dois Irmãos, near the head waters of the Rio Parahyba do Norte. My friend, Sr. D. S. Ferreira Penna, discovered another in Brazilian Guyana, in which was found the portrait urn I described and figured some time ago in the *AMERICAN NATURALIST*. Every one will remember the cave of the Atures on the Orinoco visited by Humboldt.

The burial of the dead in the hammock has been described over and over again by writers on the Brazilian Indians, and the same custom is still in force to-day among many tribes, but I do not remember having met with a description of the mode of wrapping the body in strips of bast and in palm straw.

Urn burial was practised by many ancient Brazilian tribes, and is still in use to-day in many parts of the country.

Two Tupí names are applied to the burial urn in Brazil, *ygaçába* and *camuti* or *camutim*. The former simply means a vessel to hold water, the latter a pot of any kind. It is a great mistake to suppose that either name belongs exclusively to the burial vase.

Ordinarily the vessel is not made on purpose for the body, but one of the larger earthen pots for water, or for brewing *cauim* is

used. It is safe to say that when the corpse is to be buried immediately the vase is not made on purpose. It takes time to make and ornament an earthen vessel, and true burial vases in Brazil will usually be found to contain only the cleaned bones of the dead. Those of Marajó are often made with the greatest care and most elaborately ornamented. I have already called attention to the facts that they are often true *gesichtsurnen*, wonderfully resembling those of the old world, about which so much has of late years been written by German archæologists.

As to the antiquity of the interments in the Gruta das Mumias, nothing whatever can be at present determined. At first sight, the state of preservation in some cases of hair of the skin of cartilages and dried muscles, of hammocks and bags, etc., would appear to indicate that the bodies were buried at an extremely recent date, but it is well known that, for very many years, no savage Indians have existed in the vicinity.

In the decomposition of a human body in a dry place, the soft parts disappear quickly, but the skin, the cartilages and other parts, may dry up and be preserved indefinitely. This loose material in which the bodies were buried was extremely dry, so dry that, though our explorations were made in the wet season and even during heavy rains, the negroes in working raised a thick cloud of dust, that at one time drove us from the cave. This dry material, probably containing much saltpetre, is particularly adapted for the preservation of organic substances. The human remains of the cave may be many hundreds of years old.

In the present state of our knowledge of Brazilian archæology, it is impossible to determine the tribe to which the cemetery belonged. We are ignorant of the epoch of the interment and of the history of the different tribes, that in turn have occupied the locality. Indeed, the little information that we possess of the aborigines last known to have existed in this part of southern Minas is meagre in the extreme.